Calculating Loss Budget: What it Means

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Properly managing the loss budget of your fiber infrastructure can have a positive effect on network performance and uptime. A loss budget determines how much optical power loss your fiber channel can have while still maintaining expected performance.

To evaluate this effectively, you need to calculate insertion loss (which is signal loss that occurs along a cable). Insertion loss is also called "attenuation" and expressed in decibels (dB). It's impacted by a few factors:

- Cable length (longer lengths bring more insertion loss)
- Connection points (couplers, splitters or splices, for example)
- Differences between transmitters and receivers in active equipment

If insertion loss is 3 dB/km at the required frequency, then insertion loss will be approximately 0.3 dB for a cable length of 100 m.

From there, factor in insertion loss of the connection points in the channel. This information is based on factory testing and provided by the connector manufacturer. Currently, TIA standards state that a connector's maximum insertion loss should be 0.75 dB. (The connectors on both ends of the channel need to be included as well.)

In terms of splices, TIA standards currently state that a splice's maximum insertion loss should be 0.3 dB. (Splice quality matters! A poorly completed splice or a field-terminated splice can increase loss even more.)

Why Calculate a Loss Budget?

Compare those results to the maximum insertion loss for your application – and don't forget to factor in future technology that may utilize the cable. Depending on your application, there are maximum insertion loss requirements to abide by. They ensure that signals can move from one end of the cable to the other. By adding estimated average losses together, you'll uncover your estimated total loss. Knowing this number early on in a project helps make sure that the cabling system being designed will work with the channel it's intended to be used over. After installation, calculated loss budget can be compared to test results to ensure proper installation.

When managing a fiber loss budget, you should always leave some leeway (overhead margin) for future reconfigurations or changes.

Cable loss is typically the *smallest* contributor to loss budget. The largest loss actually comes from connectors. Even if you find a cable claiming to offer the lowest loss on the market, overall performance isn't about the cable attenuation – it's about the system as a whole.

Consider a car, for example: Would you purchase a car with a smaller engine to achieve efficiency? True, the car may offer a smaller engine than all of its competitors; however, if it's less powerful and doesn't offer the best mileage, then what difference does a small engine make? Upon closer inspection, this "value proposition" doesn't hold much value at all.

The same idea holds true with cable insertion loss. You can select a cable that offers the lowest loss, but so many other factors influence the overall loss budget – and those factors matter even more than cable attenuation.